So...what's a Galah?

Galah
From Wikipedia, the free encyclopedia

The Galah or Eolophus roseicapilla, also known as the Rose-breasted Cockatoo, Galah Cockatoo, Roseate Cockatoo or Pink and Grey, is one of the most common and widespread cockatoos, and it can be found in open country in almost all parts of mainland Australia.

It is endemic on the mainland and was introduced to Tasmania,[1] where its distinctive pink and grey plumage and its bold and loud behaviour make it a familiar sight in the bush and increasingly in urban areas. It appears to have benefited from the change in the landscape since European colonisation and may be replacing the Major Mitchell's Cockatoo in parts of its range.

The term galah is derived from gilas, a word found in Yuwaalaraay and neighbouring Aboriginal languages.[2]

Contents
- 1 Description
- 2 Distribution and habitat
- 3 Classification
- 3.1 Subspecies
- 4 Breeding
- 5 Hybrids
- 6 Cultural references
- 7 Namesake
- 8 References
- 9 Citad texts
- 10 External links

Description

Galahs are about 35 cm (14 in) long and weigh 270–350 g. They have a pale grey to mid-grey back, a pale grey rump, a pink face and chest, and a light pink mobile crest. They have a bone-coloured beak and the bare skin of the eye rings is cannelated. They have grey legs. The genders appear similar, however generally adult
Australia? Isn’t this LSST@Europe?
Chemical Tagging
Galactic Archaeology (GA): disentangle Milky Way’s formation history by recovering ‘building blocks’ of the disk and halo (remnants of star formation and accretion events)

- Traces of these building blocks survive in distinct stellar abundance patterns and can be revealed by chemical tagging (e.g., Freeman & Bland-Hawthorn 2002; Mitschang+ 2013)
For chemical tagging to work within the Galactic disk, some things need to be true (or at least mostly true):
- Stars form in large aggregates
- Aggregates are chemically homogeneous
- Aggregates have unique chemical signatures (defined by several elements) which do not vary in lockstep from one aggregate to another

With chemical tagging, we can identify kinematically/spatially dispersed disk stars that are the debris of star-formation aggregates, as well as those accreted from disrupting satellites.
HERMES: The High Efficiency and Resolution Multi-Element Spectrograph

- Instrument being built for the 3.9m Anglo-Australian Telescope (AAT)
- Primary science driver: chemical tagging / Galactic archaeology
- Commissioning: October – December 2013
- Science verification: November – December 2013

10 September 2013
LSST@Europe
Institute of Astronomy, Cambridge
HERMES Details

- 4 channels with VPH gratings and $4k^2$ CCDs
- R~28,000, 200-300 Å/per channel (~1000Å total); higher resolution with a slitmask (R~45,000)
- For V~14, S/N ~ 100 in 1 hour, ~10% efficiency
- Designed to work with 2dF top end
HERMES and 2dF

• 2dF: prime focus robotic positioner with 392 data fibres and a 2º field of view
• 2dF currently used with AAOmega spectrograph (low-to moderate resolution, 2 channels)
• Minimum spacing between fibres: 30-40”
HERMES and the AAT

- HERMES will be a facility instrument on the 3.9m AAT, located at Siding Spring Observatory
- AAT is fully operational, despite the events of this past January...
The Siding Spring Bushfire, 13 January 2013
The Siding Spring Bushfire, 13 January 2013
GALAH
The GALAH Survey

**Galactic Archaeology with HERMES Survey:** designed to reconstruct the lost stellar substructures of the proto-Galaxy, and obtain a detailed physical picture of the formation and evolution of the Galaxy

### Large Observing program
- \(~10^6\) stars, complete down to V\(~14\)
- \(~3000\) plate configurations (\(~400\) stars per field) \(\Rightarrow\) can be done in \(~400\) nights of bright time \(\Rightarrow\) \(~5yr\) survey duration
- Australian-led project, with international collaborators

### Chemical Tagging
- Over 20 elemental abundances per star, from 7 independent element groups
- Spectral synthesis via automated abundance pipeline
- Relative accuracy of \(0.05 – 0.1\) dex
- First survey of its kind (and scope)
GALAH Science

GALAH seeks to address basic questions about the formation and evolution of the Milky Way, including:

• What were the conditions of star formation during Galaxy assembly?
• When and where were the major episodes of star formation in the disk and what drove them?
• To what extent are the Galactic thin and thick disks composed of stars from merger events?
• In what conditions and types of systems did accreted stars form?
• How have the stars that formed \textit{in situ} in the disk evolved dynamically?

Observability of and Expected Fractional Contribution from Galactic Components in GALAH

<table>
<thead>
<tr>
<th>Component</th>
<th>Distance</th>
<th>Fraction</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thin Disk</td>
<td>1 kpc</td>
<td>(~75%)</td>
</tr>
<tr>
<td>Thick Disk</td>
<td>6 kpc</td>
<td>(~24%)</td>
</tr>
<tr>
<td>Halo giants</td>
<td>15 kpc</td>
<td>(~1%)</td>
</tr>
</tbody>
</table>

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GALAH will have powerful synergies with GES and Gaia:

- **GES**: cross-calibration of abundances, parameters, RVs; GALAH will observe brighter stars, GES fainter stars → probing different disk / halo samples
- **Gaia**: proper motions, radial velocities and parallaxes for ~1 billion stars + GALAH → 6-D phase space info with detailed abundances for 0.1% of the Gaia sample
- **GALAH** pilot survey starts in November 2013, main survey 1st quarter 2014

Other related science:

- **HERMES** science verification time (November – December 2013) will test range of capabilities, including time domain (e.g., stellar multiplicity/ exoplanets/ asteroseismology)
• For $V \sim 14$, HERMES will achieve $S/N \sim 100$ in 1 hour; for $V \sim 17$, $S/N \sim 10^{**}$ in 1 hour ($S/N \sim 20^{**}$ in 4 hours)

• For $R \sim 28,000$ spectra with $S/N \sim 10$, $[M/H]$ and velocities can be determined with errors of $\sim 0.12$ dex and $<1$ km/s, respectively

Carney et al. 1987
HERMES and the Halo

- $V \approx 17$ would reach the TRGB out to $\sim 100$ kpc, HB out to $\sim 25$ kpc
- HERMES will be able to *directly* measure $[\text{Fe/H}]$, $[\alpha/\text{H}]$, etc. for these stars, as well as obtain precision RVs
- Streams / faint satellites in the halo are diffuse and extend over large areas of the sky – wide FoV + $\sim 400$ fibres ideal for studying halo substructure

Mochejska et al. 2001
Other Science with HERMES: The Spectrograph

- Skymapper / LSST followup
- Substructure in the halo and studies of closest Milky Way satellites
- Magellanic Clouds
- Globular and open clusters
- Stellar astrophysics
- Time Domain: Stellar binarity and variability, planet searches, asteroseismology, etc., etc.
And now for something (somewhat) different...
• Proposal to use UKST 1.2m telescope with TAIPAN spectrograph (R~2000, 3700-8700Å, 150 [300?] starbugs over 6° FoV, early 2016**) to get spectra of all southern stars down to V~12 (2.5M stars)
• S/N~100 @ V~12 in 3 min, fibre configuration time ≤ 3 min; can get [Fe/H], [α/Fe], $T_{\text{eff}}$, log(g)
• Funnelweb Faint: S/N~30 for V~17 in ~1 hr dark time…
Summary

• Chemical tagging promises to be a powerful technique for deciphering the history of the Galactic disk

• HERMES is a new wide-field (2°), highly-multiplexed (~400 fibre) high-resolution (R~28K/45K) spectrograph for the AAT, optimised for stellar abundances

• GALAH is a new survey starting early 2014 (pilot survey begins November 2013) to obtain detailed abundances of up to 25 elements for ~1M stars, down to V~14

• FUNNELWEB: proposed medium-resolution (R~2K) survey of southern stars down to V~12 with the TAIPAN spectrograph (6° FoV, 150 / 300 fibres); fainter magnitudes (V~17)possible in dark time
The **GALAH** team, seated on a horizontal branch

For more information about **GALAH**, see
